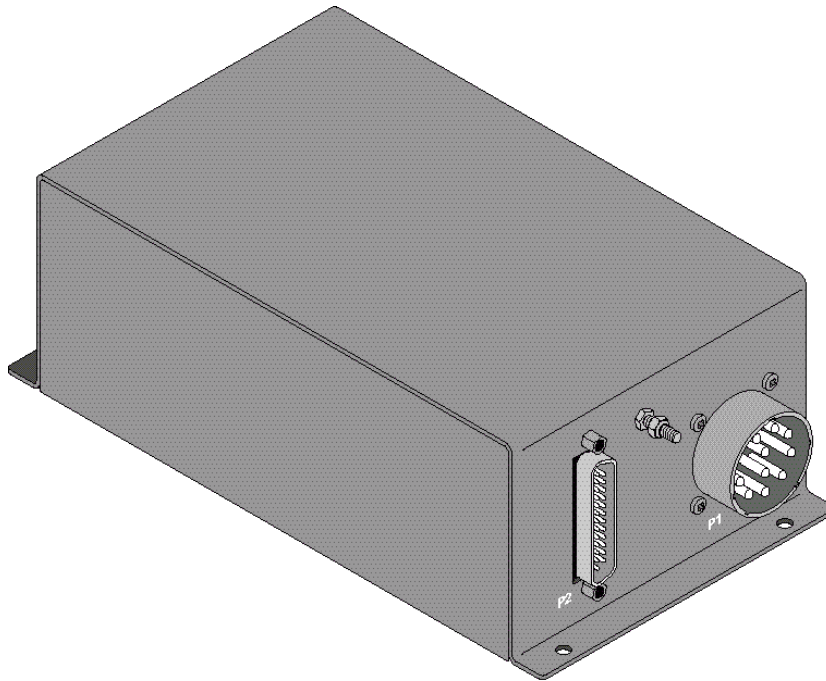


Installation & Operations Manual

Model #: PA-475-01-x

Stereo/Subwoofer Amplifier

Document #540144



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MODEL # PA-475-01-x

Stereo/Subwoofer Power Amplifier

1.0 General Information

1.1 Introduction

This manual contains information for the proper application, installation, and operation of the Audio International, Inc. (AI), Stereo/Subwoofer Power Amplifier, Model No: PA-475-01-x. The “-x” suffix designates the type of connector utilized. Also included are physical and electrical characteristics of the unit.

1.2 Purpose of the Equipment

The PA-475-01-x is a 300-watt, 4 channel, Class D stereo/subwoofer power amplifier. The unit accepts low level entertainment audio source inputs and amplifies them to levels suitable for driving speakers. The amplifier has inputs for the aircraft’s page/chime function along with PA override to mute the entertainment audio when the page function is utilized.

There are four (4) sets of speaker outputs that can be configured to drive up to four (4) full-range speakers or two (2) high-range speakers and two subwoofers depending on unit configuration mode. The amplifier is one of the building blocks of a complete cabin audio system.

1.3 Operational Features

Listed below are key features of the PA-475-01-x:

- ❑ Output power 4 x 75 watts RMS, less than 1% THD
- ❑ Class D
- ❑ Can be configured for up to 4 full-range speakers or 2 high-range speakers and two subwoofers
- ❑ Two (2) entertainment audio inputs in full-range mode, one (1) input in bi-level mode
- ❑ PA key overrides entertainment audio
- ❑ Controlled and interfaced with AI control equipment via AI’s proprietary RS485 serial data bus
- ❑ Emergency power input
- ❑ Weight-on-Wheels configurable over AI’s proprietary RS485 serial data bus; audio level can automatically be increased or decreased while in flight
- ❑ Solid state circuitry
- ❑ Compact, lightweight housing
- ❑ Low heat generation

1.4 Optional Equipment

Audio International, Inc. offers a complete line of speaker systems to enhance any aircraft entertainment system.

Contact your AI representative for details.

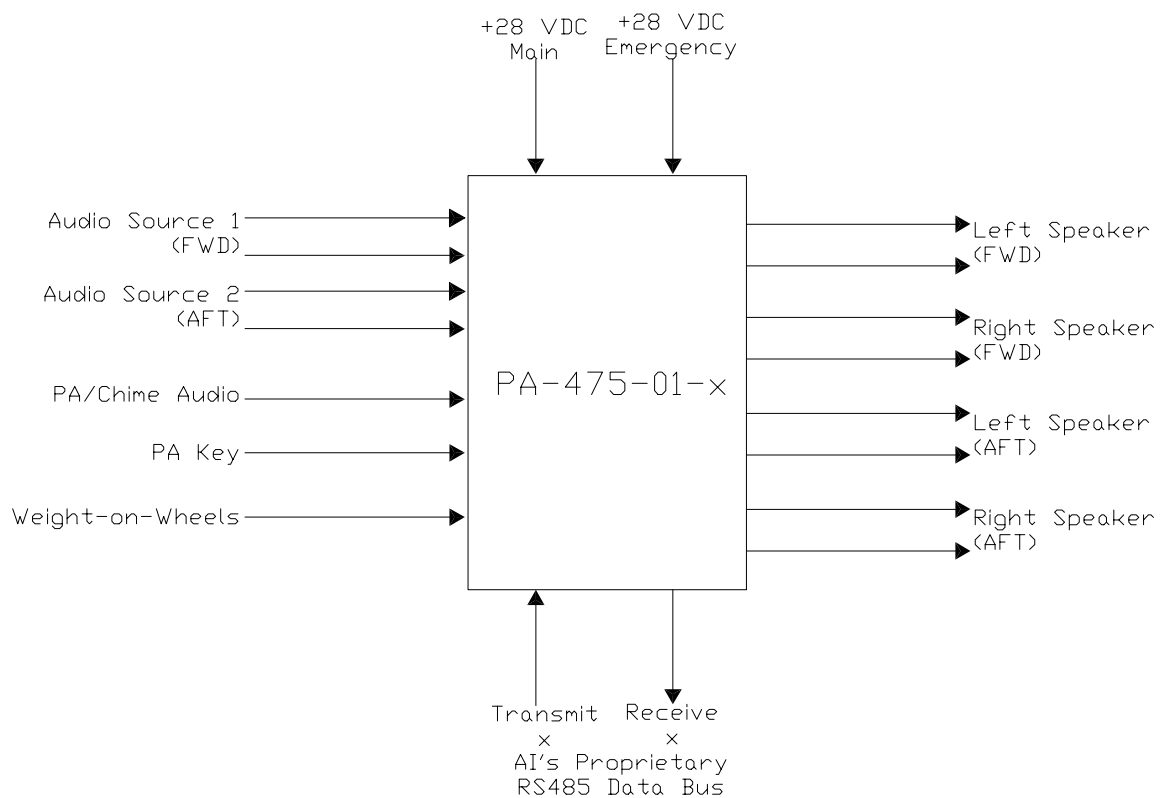
2.0 Application

2.1 Introduction

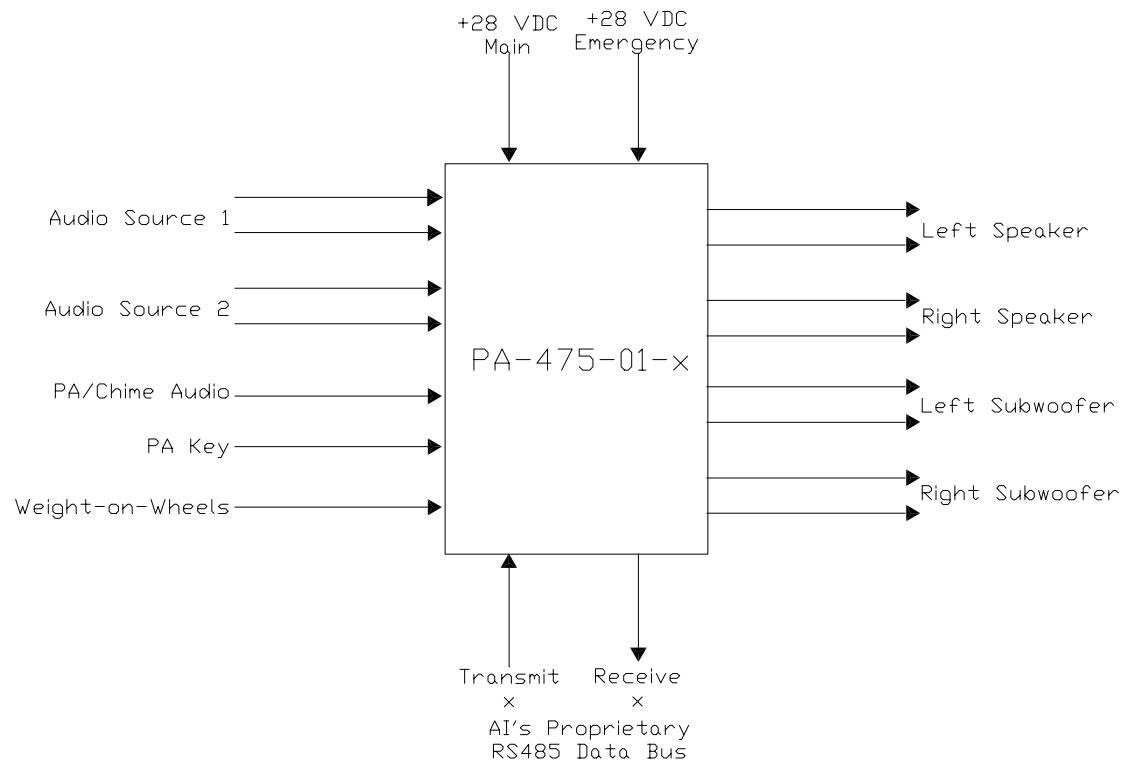
The PA-475-01-x is part of a complete cabin audio entertainment system. The application of the unit is specific to a particular aircraft based on the desires of the customer or designer.

2.2 Block Diagram – Typical Application

2.2.1 Bi-Level Mode Application



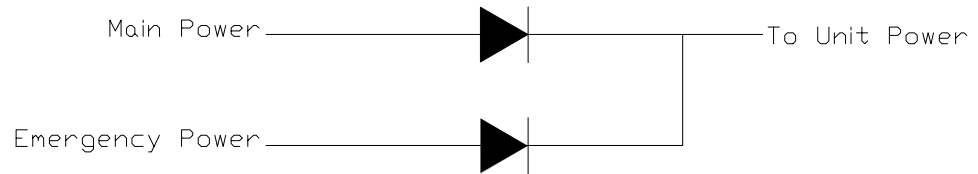
2.2.2 Split Level Mode Application



2.2.3 The PA-475-01-x provides amplification on four (4) channels at 75 watts RMS minimum with output impedance of 4-ohms. This amplifier is configurable via AI's proprietary RS485 serial data bus as dual independent stereo amplifiers or as one stereo amplifier and one bi-level amplifier. Additionally, the amplifiers may be specified to power-up with speakers active or inactive.

2.2.4 A weight-on-wheels (WOW) input is provided for use that will effectively increase or decrease the amplifier output levels based upon pre-determined software configuration settings. Activation of this input will increase or decrease the amplifier output by as much as +/- 20dB. The weight-on-wheels input is constant ground active (<1.2VDC to activate). The weight-on-wheels level adjustment will continue until the ground input is applied.

- 2.2.5 Emergency power input provides for necessary power to power amplifiers and PA/chimes controls during emergency conditions. If both amplifiers are configured for full range operation (split-cabin), then both amplifiers will be powered when this input is activated.



If the second internal amplifier is configured as a bi-level amplifier, the unit will automatically deactivate the subwoofer amplifier whenever the main power is removed and will reactivate automatically when the main power is restored (if on prior to the main power deactivation).

As shown in the diagram above, the two power inputs on the P13 connector are wired in a diode 'OR' configuration allowing for operation from either power bus.

2.3 Data Bus Control

Multiple amplifier configurations are possible utilizing AI's proprietary RS485 serial data bus, allowing independent control of each unit. The number of possible amplifiers in a system is dependent on other modules used within the cabin audio system, maximum eight (8) amplifiers.

There are no controls on the PA-475-01-x. Operational control of the unit is handled by commands via AI's proprietary RS485 serial data bus. Programmable features are set upon installation utilizing an external PC (typically a laptop). A software program designed by AI specifically for this task enables the following features:

- Unit ID for control of the amplifier from various locations in the aircraft in a multi-amp configuration
- Initiation of the bi-level mode to utilize the crossover on the four speaker outputs for subwoofer and high range usage
- Settings for Weight-on-Wheels input
- Audio level controls
- Speaker power up – "OFF or ON"

3.0 Installation

3.1 Prior to Installation

Prior to installation, the following items should be considered:

3.1.1 During the design and layout of the aircraft cabin, careful consideration of the location of this module is necessary. Some of the items to be considered include:

- Space
- Available power supply
- Environmental conditions (temperature, humidity, etc.)
- Length of cable runs
- Location of other aircraft systems (i.e. oxygen delivery)

3.1.2 The PA-475-01-x must be installed to conform to the standards designated by the customer, installing agency, and existing conditions as to the unit location and type of installation.

3.1.4 Mounting screws are required to secure the unit. Refer to Section 7.0, Reference Drawings, for mounting hole diameters and configuration.

3.2 Unpacking and Inspection

Carefully open the packaging and remove the PA-475-01-x. Verify that all components have been included in the package per the packing list. Inspect the unit for damage. Retain the packing materials and packing list.

If damage has occurred during shipping, a claim must be filed with AI within 24 hours and a "Return Request Authorization Number" must be obtained from AI. Refer to the front cover of this manual for address and telephone number of Audio International. Repackage the unit in its original packaging materials and return it to AI following instructions given by the AI representative. If no return is necessary, retain the packing materials for storage or reshipment.

3.3 *Cautions and Warnings*

- 3.3.1 It is important to do a pin-to-pin power and ground check on all connectors. Ensure that power and ground are applied only where specified. Damage to the unit may result if power or ground is applied to the wrong points.
- 3.3.2 **DO NOT** connect or disconnect the module while power is applied.
- 3.3.3 **DO NOT** remove any factory-installed screws. Damage to the units may result and void any warranties.
- 3.3.4 Ensure the amplifier is properly grounded from the grounding lugs on the case to the aircraft frame.
- 3.3.5 **DO NOT** connect or disconnect any speaker when power is applied to the amplifier.
- 3.3.6 ESD (Electro Static Discharge) guidelines shall be followed.

3.4 Wiring Requirements

3.4.1 Introduction

The installing agency shall supply and fabricate all external cables and mating connectors. The length and routing of external cables must be carefully studied and planned before attempting installation of the equipment. Allow adequate space for installation of cable and connectors. Avoid sharp bends and placing cables near aircraft control cables. Maintain a minimum clearance of three (3) inches from any control cable. If wiring is run parallel to combustible fluid or oxygen lines, maintain a separation of six (6) inches between the lines.

3.4.2 Audio Lines

All audio input cables shall be 22 AWG minimum twisted shielded pair. Audio output cables shall be 18 AWG minimum, 16 AWG preferred. All audio input and output lines require twisted, shielded cable with the cable shields grounded at the source.

3.4.3 Power Wires

All power and ground wires shall be 16 AWG, minimum. Power ground wires must be grounded within twelve (12) inches of the unit. All wires shall be in accordance with **MIL-W-22759** or equivalent. Protect power wires with circuit breakers or fuses located close to the electrical power source bus. Ground the stud within 12" of the unit using 10 AWG, minimum.

3.4.4 AI's Proprietary RS485 Serial Data Bus

The PA-475-01-x is designed to interface with other AI equipment via AI's proprietary RS485 serial data bus. This is a serial data bus that allows multiple units to be connected.

The data bus is to be implemented using a twisted shielded pair cable in accordance with **MIL-W-27500** or equivalent. The wire size for the conductors in this cable is to be 22 AWG (minimum). The shield is to be connected wherever a shield pin is provided. Shield terminations are to be made as close to the connector pin as possible. In the event shield pins are not provided, the data bus shield must be terminated per AI's proprietary RS485 specification.

All modules on the RS485 data bus shall be connected in a "daisy-chain" configuration. AI's proprietary RS485 serial data bus specification is available upon request.

3.5 Physical Characteristics

3.5.1 Refer to Section 6.0 for unit dimensions.

3.5.2 Refer to Section 7.0 for attachment points.

3.5.3 When mounting the unit, allow sufficient space for mating connectors.

3.5.4 Allow a minimum of 1-inch air space around the amplifier for heat dissipation.

3.6 Electrical Characteristics

3.6.1 Refer to Section 6.0 for electrical specifications.

3.6.2 Two connectors are available on the PA-475-01-x. P1 is an 11-pin connector designed to mate with an "Amphenol" connector. The signals interfaced through P1 are two sets of left/right speaker outputs, +28 VDC main input, and +28 VDC emergency input. The emergency input is required for cabin page and chime functions in case of primary systems power failure.

P2 is a 25-pin connector. The signals interfaced through P2 are the entertainment inputs of left/right audio input, PA/chime audio, PA key, data ID, and AI's proprietary RS485 data bus. The data ID pins are utilized to identify each unit on the data bus in a multi-amplifier system. These are binary ID pins and allow multiple amplifiers to be installed in the aircraft.

3.7 Mating Connector Information

All wiring harnesses to the unit are supplied and fabricated by the installing agency.

Model #	Pin #	Mating Connector
PA-475-01-1	P1	MS3126F-18-11S Amphenol
	P2	RD25F10JVL0 (Positronic)
PA-475-01-2	P1	MS3126F-18-11S Amphenol
	P2	DBMA-25S (D-subminiature)

3.8 Pinout Assignment Descriptions

P1	
Pin #	Description
A	+28 VDC Main Input (Chime/PA)
B	Ground
C	Right Speaker Output #1-High
D	Right Speaker Output #1-Low
E	Left Speaker Output #1-High
F	Left Speaker Output #1-Low
G	Right Speaker Output #2-High
H	Right Speaker Output #2-Low
J	Left Speaker Output #2-High
K	Left Speaker Output #2-Low
L	+28VDC Emergency Input (Chime/PA)

P2	
Pin #	Description
1	Left Audio Input #1-High
2	Left Audio Input #1-Low
3	Right Audio Input #1-High
4	Right Audio Input #1-Low
5	Left Audio Input #2-High
6	Left Audio Input #2-Low
7	Right Audio Input #2-High
8	Right Audio Input #2-Low
9	PA Audio Input-High
10	PA Audio Input-Low
11	PA Key Input (Ground Active)
12	ID1 Input
13	ID2 Input
14	ID3 Input
15	ID Common
16	Data Bus A
17	Data Bus B
18	Data Bus Shield
19	Weight-on-Wheels Input (Gnd Active)
20	Reserved
21	Reserved
22	Reserved
23	Reserved
24	Reserved
25	Reserved

3.9 Post-Installation Test

3.9.1 Verify +28 VDC power has been connected to the unit. With the aircraft power "ON", select a piece of audio source equipment and operate the unit to create audio signal to the PA-475-01-x. Verify output is present at each speaker or subwoofer connected to the amplifier. Repeat the procedure for each audio source unit in the system. Verify each switch and controller in the system selects each piece of source equipment.

- 3.9.2 From any switch or controller, operate the volume up/down function. Verify output levels from the PA-475-01-x change accordingly. Verify high volume is sufficient; verify lowest volume setting eliminates speaker output. Repeat the procedure from all other switches and controllers designated to operate the PA-475-01-x.
- 3.9.3 With an entertainment audio operational, key and speak into a microphone to ensure the page/chime overrides the entertainment audio. Repeat the procedure for all microphones on the aircraft. Verify the briefer audio can be heard through the speakers.
- 3.9.4 Remove main power from the amplifier and verify +28 VDC emergency power is present by operating the PA system. Verify the subwoofers are disabled while emergency power is applied.

4.0 Operations

4.1 Introduction

Power to the PA-475-01-x is initiated when the aircraft power is turned "ON". The power remains "ON" at all times and amplified audio output is generated whenever a source is selected, operated, and ensure speakers are in the "ON" state.

4.2 Audio Source

Load an entertainment audio source with selected material. Select the audio input and operate the volume options from any passenger control panel in order to supply a signal to the amplifier.

4.3 PA/Chime Function

When a PA microphone key is pressed, all other audio source signals are automatically overridden and PA audio is present in the speaker system.

5.0 Troubleshooting

5.1 General Troubleshooting Procedures

Many problems can be isolated with the following general techniques:

- To verify power to the unit, recheck +28 VDC power is applied to the proper pins on the unit. Use a voltmeter to verify correct level.
- Reset by removing power from the unit for at least one minute and reapply power. Verify the problem still exists.
- Recheck all connections to the unit for security. Check all harness runs for possible pinching, wire breaks, etc. Recheck all pinouts for application accuracy.

5.2 Troubleshooting Chart

Problem	Possible Cause	Solution
No sound from any speakers	Source equipment problem	Verify correct source selected Verify audio output from source Check audio in line to amplifier
	No power to amplifier	Verify +28 VDC input Check aircraft's circuit breaker or fuse
	Wiring harness problem	Check harness for pinch or cut Check pinouts are correct at amplifier
	Speakers turned "Off"	Verify speaker controls are "ON"
No sound from one speaker	Wiring harness problem	Check connections at speaker Check pinouts are correct at amplifier Check harness for pinch or cut
	Bad speaker	Replace with know "good" speaker
Poor sound quality	Source equipment problem	Verify problem exists with other source equipment
	Ground problem	Verify case ground strap secure Verify grounds on wiring harness pinned correctly
	Speaker problem	Check speaker wiring for correct +/- phase Replace bad speaker with known good speaker
No or low subwoofer output	Wiring harness problem	Check speaker wiring for correct +/- phase Check pinouts are correct at amplifier
	Inactive crossover	Set bi-level mode using AI configuration software

6.0 Specifications

6.1 Unit Specifications

Physical Specifications	
Housing	Aluminum
Dimensions (L x W x H)	8.0" x 4.74" x 2.69" 20.32cm x 12.04cm x 6.83cm
Weight	2.6 lbs / 1.16 kg

Electrical Specifications	
Power	5A nominal, 12A maximum @ +28 VDC
Operating Range	+18 to +32 VDC, +28 VDC nominal
Emergency Power	6A maximum @ +28 VDC PA/Chime
Data Bus Type	AI Proprietary RS485 / db2

Audio Specifications	
Frequency Response	20 Hz – 20,000 Hz
Electronic Crossover	High Range: 135 Hz – 20,000 Hz Low Range: 20 Hz – 135 Hz Configurable activation
Output Power	4 channels x 75 watts RMS 4 channels x 150 watts maximum
THD at Rated power	Less than 1%
Inputs	2 x stereo audio PA/Chime mono audio
Audio Input Signal Level	2 V RMS optimum 1 V RMS minimum
Input Impedance	4.7 k-ohms
Outputs	4 Speakers
Output Impedance	4-ohms
PA/Audio	Low-level PA input Range: 200mV to 2V RMS – adjustable

7.0 Reference Drawings

The following diagrams show the unit dimensions and connector locations for the PA-475-01-x. All dimensions are shown in inches.

